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surfaces within a few cm. of the expanding masses of cells, but local transpiration may have resulted in actual shrinkage. The optimum temperature for this plant is also a feature not yet determined.

The growth of the opuntias therefore takes place during a period of decreasing acidity resulting from the disintegrating action of light and rising temperatures. This statement applies not only to the diurnal behavior of the plants during the growing season, but to the growing season as a whole, which as Dr. H. M. Richards has pointed out in a paper now in press is one of diminishing acidity. The acidities of the cacti are calculated for the sap of the plants. The acidities of N/100 to N/3,000 found by Borowikow to be favorable for hydration and growth were of the culture solution; that of the sap of the seedling used was probably still much lower.

Light and temperature in lesser degree are seen to exercise a totalized releasing effect on growth coincident with reduced acidity and increased hydration, to a certain limit. Beyond this growth rate is checked. Further analytical tests will be necessary to determine the limiting factors.

D. T. MACDOUGAL

DESERT BOTANICAL LABORATORY

PROCEEDINGS OF THE ANNUAL MEETING
OF THE AMERICAN SOCIETY OF
ZOOLOGISTS HELD IN PHILADELPHIA, 1914. II

Multiple Human Births: G. H. PARKER.

Multiple births are well known among human beings and the proportions of twins, triplets, and quadruplets to single births have often been recorded. Instances of five and six children at a birth are very rare but apparently well authenticated. All cases above six are very doubtful. In the *Boston Medical and Surgical Journal*, Volume 10, page 224, 1872, is recorded from Trumbull County, Ohio, a case of eight children at a birth. This very circumstantial account, which has been quoted in numerous books and journals, proves on investigation by the county clerk of Trumbull County to be entirely fictitious.

Comparative and General Physiology

Effect of Electrolytes Upon the Rate of Nerve Conduction in Cassiopea: ALFRED G. MAYER.

Further Studies on the Behavior of Amoeba: ASA A. SCHAEFFER.

The Significance of Certain Internal Conditions of the Organism in Organic Evolution: F. H. PIKE AND E. B. SCOTT.

Zoologists, while studying the phenomena of form regulation in animals, have given comparatively little thought to the regulation of internal conditions—the changes in matter and energy in the organisms which underly the changes of form.

The data accumulated in the physiological laboratories show that in the higher animals there is a regulation, varying within relatively narrow limits, of body temperature, the blood pressure, the tension of carbon dioxide and oxygen, of the concentration of hydrogen and hydroxyl ions, of the osmotic pressure, and of the general composition, quantitative as well as qualitative, of the fluids of the body, brought about by a number of systems and organs of the body.

From the point of view of the physical chemist, the general constancy of internal conditions of the higher organism may be interpreted in terms of chemical equilibrium. If the reactions within the body are of the nature of the "slow" reactions of the chemical laboratory, the constant temperature and the constant physico-chemical concentration of the body fluids would be attended by a speed of reaction within the body which would be, in a considerable degree, independent of the conditions in the environment. The internal mechanisms of the organisms lie at the base of the diminishing effect of the environment, or the greater degree of independence of the animal from the conditions of the environment as the organisms occupy successively higher positions in the evolutionary scale.

Experiments on X-Radiation as the Cause of Permeability Changes: A. RICHARDS.

Some Factors Concerned in the Death of Paramoecium at High Temperatures: M. H. JACOBS.

The Effect of Color in the Environment on the Color Changes of Anolis Carolinensis: MANTON COPELAND.

It is well known that the so-called *Florida chameleon*, *Anolis carolinensis* Cuv., becomes green in the dark and almost invariably turns brown in daylight. To test the effect of color in the environment on the color changes in the skin of the lizard, the animals were placed in boxes lined in part with colored paper and exposed to daylight. It was found that the green color was often assumed under such conditions. A yellow environment always induced a change from brown to

green. Green surroundings were nearly as effective in bringing about this reaction, whereas red and blue were much less so. When placed in a white box certain individuals became green. The brown color was assumed when a box lined with black paper was substituted for a color box. The green hue persisted with slight change for several hours when the animal was in the yellow environment.

When a lizard was blindfolded it remained brown in the yellow box, and numerous tests showed conclusively that the organs concerned in receiving light stimuli, which induced a color change in the skin from brown to green, were the lateral eyes.

The Absorption of Fat by Fresh-water Mussels:

E. P. CHURCHILL. (Introduced by Caswell Grave.)

The work was undertaken for the U. S. Bureau of Fisheries with the object of ascertaining whether or not aquatic animals use food which is in solution in the water. Mussels were kept in soap solutions made from olive oil, both unstained and stained with Sudan III. Histological examination of such mussels and of controls revealed the fact that fat is absorbed abundantly and carried over the body by the blood corpuscles and plasma. Sections of mussels kept in fat solutions short periods, as 18 or 24 hours, showed such a heavy loading of fat in the epithelium of gills, mantle and foot that it seemed very probable that the cells of such epithelium absorbed the fat directly from the solution. Mussels with the valves wedged open were suspended over the solution, so that only the ventral part of the foot and mantle were immersed, the mouth and siphons being above the solutions. Examination after some hours of the parts of epithelium so exposed showed more fat than in the epithelium of other parts or in that of the corresponding regions of the control. Fat can be absorbed from solution by the epithelium of intestine and probably outer body walls.

Vision in Flounders: S. O. MAST.

Flounders, especially *Paralichthys* and *Ancylosetta*, simulate the background to a most remarkable degree. The process of simulation involves changes in shade, in pattern and in color. Since all of these changes are controlled by stimuli received through the eyes, the nature and the degree of simulation of the background constitutes an excellent criterion of vision, in so far as this term may be used in a purely objective sense.

On the basis of this criterion it was found that, in regard to shade and color, vision in fishes is es-

entially the same as it is in human beings. It was also found that these animals distinguish between dots 2 mm. and 3 mm. in diameter respectively, that they recognize dots 1 mm. in diameter but that they do not recognize dots 0.5 mm. in diameter.

By means of a background consisting of a rotating disk which contained alternate black and white sectors, it was found that the fusion-rate of images in flounders corresponds very closely with that in the human being, indicating that in regard to motion vision in fishes is as acute as it is in man.

On a background containing only gray or black and white, no color is produced in flounders regardless of the shade or pattern or the intensity of the light. Simulation in color is consequently dependent upon the length of the waves of the light, not upon differences in its intensity. It therefore strongly supports the contention that fishes have color-vision. This is, moreover, supported by the fact that flounders adapted to a given color tend to select a background of the same color, and the fact that this selection is of such a nature that it can not be accounted for on the basis of difference in the intensity of the light reflected by the different colors. Thus the contention that fishes have color-vision is supported both by the reactions of the animals and by the reactions of the chromatophores in the skin.

Influence of Thyroid Ingredients on Division-rate in Paramœcium: R. A. BUDINGTON AND HELEN F. HARVEY.

Paramœcia of known ancestry were placed in bacterial infusions of known composition. These were kept on hollow slides in moist chambers in the usual manner. To certain slides were added equal amounts of dried thyroid glands taken from types of each of the five main subdivisions of Vertebrata. Besides each thyroid-treated line was carried a control line, two progeny of a single dividing individual being used in the experiment.

The number of individuals resulting from fission in each line was counted each day; at the end of six days the following were the data secured, each figure being the average of three repetitions of the same experiment:

Fish thyroid	70.6
Control	36.6
Amphibian thyroid	111.3
Control	20.0
Reptilian thyroid	225.3
Control	24.3

Avian thyroid	222.0
Control	43.6
Mammalian thyroid	315.3
Control	57.3

The conclusion is that throughout the evolution of the vertebrate phylum, the thyroid has retained certain of its physiological characters intact. The observations previously made by Nowikoff, later by Shumway, on mammalian thyroid influence on *Paramæcium* are thus confirmed, and the significance of the facts extended so as to include the homologous glands of each of the other four classes of vertebrates.

The Effect of the Removal of the Marginal Sense Organs on the Rate of Regeneration in Cassiopea Xamacana: LEWIS R. CARY.

The results of the investigations of most workers on regeneration has shown that no direct effect of the nervous system upon regeneration could be demonstrated. Zeleny concluded as a result of his work on *Cassiopea* that when the sense organs were removed the animals regenerate sometimes faster and sometimes slower than do specimens with the sense organs intact. Stockard removed the sense organs from one half of a *Cassiopea* disk and insulated the two halves by removing a strip of sub-umbrella tissue so that one half was active, the other inactive, and found that the rate of regeneration was the same in both halves. From these experiments he concluded that muscular activity had no influence on the rate of regeneration.

In a large series of experiments on *Cassiopea* disks prepared in the manner just mentioned I have obtained the following results:

1. When entire disks are used for the experiments those from which the sense organs have been removed may regenerate slower or faster than those retaining their sense organs on account of individual variation in the rate of regeneration.

2. In specimens prepared so that one half is active, the other inactive, the active side (that bearing the sense organs) always regenerates fastest. The difference in rate is particularly noticeable in earlier stages of regeneration.

3. When the sense organs are removed from one half of the disk, but the halves not insulated, the rate of regeneration is the same for both sides. If only a single sense organ remains the results are the same.

4. In a solution made up of sea water to which has been added 15 volumes per cent. of 0.6 M

MgSO₄ the regeneration is equal from both sides, but at the rate of the inactive half of a specimen from which one half the sense organs have been removed.

5. In specimens from which all sense organs have been removed but in which one half is kept in pulsation by means of a trapped wave of contraction, the regeneration is the same for both halves, although the rate of contraction in the active half may be higher than for a half disk on which the sense organs are present.

The rate of metabolism as determined for the writer by Dr. S. Tashiro is higher for the half disk bearing sense organs than for the inactive half, or for the half that is kept in contraction by means of a trapped wave.

The Locomotion of Actinians: G. H. PARKER.

The creeping habits of *Metridium* and *Sagartia* were studied at Woods Hole and of *Condalactis* and *Actinia* at Bermuda. *Metridium* and *Sagartia* creep slowly and in directions which may be in one individual at right angles to its axis of structure, in another coincident with it, and in still another oblique to it. Whether one individual could assume in sequence all these directions was not ascertained for these sea anemones. In *Condalactis* and *Actinia* the creeping was more actively carried out than in *Metridium* and *Sagartia*. A single *Actinia* crept now in the direction of its axis, now at right angles to it, and now in some other direction. There is no reason to suppose that this freedom is not possessed by the other sea anemones. In all the forms studied locomotion was accomplished by a wave-like movement of the foot. This began at the rear edge of the foot and proceeded to the front edge. It was exactly like the direct type of wave seen in the mollusk foot, but could be established temporarily on any axis. In *Condylactis* it required about three minutes for a wave to pass over the foot and with each wave the animal progressed a little over a centimeter in distance.

The Behavior of an Enteropneust: W. J. CROZIER.

A species of *Ptychodera* found in Bermuda was studied with reference to its movements and sensory reactions. The orderly progression of peristaltic waves on the thorax and abdomen was found to depend upon the continuity of the dorsal and ventral nerve cords. At night the animal responded to general mechanical stimulation by the emission of a phosphorescent material from the collar region. *Ptychodera* showed "differential sensitivity" to light; it was not photographic.

Local reactions were obtained in response to mechanical and chemical stimulation, the order of decreasing sensitivity of the parts of the animal being: proboscis, posterior end, genital pleurae, the alkaline metals the normal lyotropic series, abdominal surface, collar. For the chlorides of $K > NH_4 > Li > Na$, was found to express their stimulating efficiency; this was mainly a cation stimulation, but in the case of salts ($CaCl_2$, *e. g.*) which did not stimulate strongly, other anions (in this case $Ca(NO_3)_2$) were effective as stimulating agents. Photic sensitivity was readily separated, by exhaustion or anæsthetics, from mechanical and chemical; but for the two latter forms of irritability no physiological separation was discoverable. It is therefore suggested that in *Ptychodera* there are generalized receptors open to stimulation by both mechanical and chemical means.

On a Certain Fibrin Reaction Which Occurs in Living Cultures of Frog Tissues: GEORGE A. BAITSELL.

In living cultures of various tissues of the adult frog there occurs, in many instances, a transformation of the fibrin net of the plasma clot in which the living tissue is embedded. In general the changes which occur first make their appearance when the culture is from two to three days old. During these changes the elements of the fibrin net appear to fuse or consolidate and as a result there are formed a great number of fine wavy fibrils which unite to form bundles of fibers, and these freely intertwine and anastomose as they ramify throughout the area of the plasma clot. The transformation of the fibrin net begins first in the region of the clot which lies in immediate contact with the embedded tissue and gradually extends to the distal regions of the clot until after a time practically the entire plasma clot becomes changed into a tissue greatly resembling that found in various types of connective tissues. Photographs of both living and preserved cultures have been made to show the transformation of the clot and the development of the fibers. Experimental work shows definitely that the fibers arise by a transformation of the fibrin net and are not due to any intracellular action. The work also indicates that the transformation will not take place without the influence of living tissues, although mechanical factors may be introduced which will aid in the formation of the fibers. Various experiments made to determine the true nature of the fibers give conflicting results. The fact, however, that the fibers have also been found

to occur in the fibrin net during wound healing indicates that they play an important part in such a process. Studied histologically with a Mallory stain, there appears to be nothing to differentiate them from regular connective tissue fibers. Work is in progress to determine their final fate and the relation they bear to permanent connective tissue fibers.

Studies on the Phosphorescent Substance of the Fire-fly: E. NEWTON HARVEY.

Dried powdered luminous tissue of the fire-fly will phosphoresce strongly if moistened with water containing oxygen. If first extracted with boiling ether or a mixture of equal parts boiling ether and alcohol for eight hours and the solvent then removed, strong phosphorescence still occurs when water containing oxygen is added to the dry powder residue. Similar results are obtained with hot chloroform and acetone, and cold carbon tetrachloride and toluol.

If oxygen-free water is added to the dry powdered luminous tissue no phosphorescence occurs. If oxygen is then added light is emitted. But if no oxygen be admitted until an hour or more after contact of the powder with oxygen-free water, then phosphorescence does *not* occur. Salt, acid and alkaline solutions give similar results.

From these experiments we may conclude: (1) that the photogenic material is not a fat or a lecithin; (2) that the photogen or some accessory substance is unstable and decomposes in the presence of aqueous solvents even though oxygen be absent. The change is therefore not oxidative in nature. It is well known that the photogen oxidizes readily in presence of oxygen and is used up with light production.

Dried luminous bacteria give similar results, with this exception, that extraction with chloroform, acetone and a mixture of equal parts boiling alcohol and ether destroys or weakens the powder to phosphorescence. The bacterial photogen is also unstable if the bacterial cell is broken up in the absence of oxygen.

Some Experiments on Fundulus Eggs Aiming at the Control of Monstrous Development: E. J. WERBER.

Starting from the assumption that human and other mammalian monsters found in nature may be due to a pre-uterine or intra-uterine poisoning by the substances found in the blood under pathological conditions of metabolism, such as diabetes, nephritis, jaundice, etc., eggs of *Fundulus hetero-*

clitus were subjected to the action of solutions of urea, butyric acid, lactic acid, sodium glycocholate and ammonium hydroxide. Conclusive results were obtained only with butyric acid and acetone.

The effects of both these substances are very similar. If *Fundulus* eggs are subjected to their influence, they will give rise to a great variety of monsters. Cyclopia, asymmetric monophthalmia and neuroplastic development (microembryones, hemiembryones anteriores) were found to occur most frequently. Not uncommonly is the occurrence of acardia in malformed embryos. In some eggs a heart and rudimentary blood-vessels have developed without the presence of an embryo.

The ear vesicles are very often involved in malformations, their size being enormous, owing apparently to edema. Some locomotor anomalies in embryos, which had hatched, pointed to injury sustained by the semicircular canals.

The rarest in occurrence, but probably the most significant from the standpoint of experimental embryology, were found some cases where all that had developed in the egg was a fragment of brain tissue which had given rise to an eye. This "solitary" eye was found to be almost perfect in some cases, while in others the choroid fissure had failed to close ("coloboma"). Sections of one of these eggs show an eye typical in structure. This would seem to establish the fact of the ability of independent development of the eye.

Reactions to Light in Vanessa lantiopa, with Special Reference to Circus Movements: WM. L. DOLLEY, JR. (Introduced by S. O. Mast.)

The Reactions of the Melanophores of Amblystoma Larvæ: HENRY LAURENS.

A Case of the Change of Fat, in Nature, to Calcium Soap: R. W. H. WOLCOTT.

The Balance Between the Hydrochloric Acid of the Stomach and the Sodium Carbonate of the Pancreas in Its Relation to the Absorption and Utilization of Sugar: J. R. MURLIN.

The Electric Nerve Centers in the Skates: ULRIC DAHLGREN. (With lantern.)

Food Reactions of the Proboscis of Planaria: WM. A. KEPNER AND ARNOLD RICH.

The removal of part of the proboscis sheath results in exploratory movements of the proboscis. As the sheath is further removed these exploratory movements become more pronounced. Such movements, however, are not maintained for more than two minutes.

Sectioning the living animal posterior to the

base of the proboscis does not disturb in any other manner the proboscis. By removing anterior parts of the body little disturbance of the proboscis results until the plane of sectioning gets quite near the base of the proboscis, when the latter undergoes either mechanical or autoamputation and leaves the proboscis sheath and for at least ten minutes swims about as an independent organism, ingesting food in a futile manner. The proboscis thus freed frequently turns upon its own body and by ingesting it reduces the body to mere pulp.

It is concluded, therefore, that there is resident in the proboscis an instinct to ingest objects. The inhibitory control of this instinct does not lie in the dorsal ganglia, but in a region of the body anterior to and quite near the base of the proboscis.

Preliminary Report on the Relations Between the Reactions of Rhabdocæles and Their Environments: WM. A. KEPNER AND W. H. TALIAFERRO.

In a previous paper² the authors showed that *Microstoma caudatum* when kept under laboratory conditions shows two physiological conditions. In the first place if they are experimented on a few hours after collection they will distinguish between their aquarium water and 5/100 per cent. ordinary salt solution. However, if they are experimented on over a day after collection they do not make this distinction, thus showing that their physiological condition has been lowered. We, likewise, showed that this lowering of physiological condition is due to the rapid accumulation of bacteria under laboratory conditions.

While experimenting on a number of other species of *Rhabdocæles* we found that some showed this loss of physiological condition just as *Microstoma*, while others showed no lowering of their physiological condition, no matter how long they lived under laboratory conditions.

To find an explanation of these results, which at first seemed contradictory, we investigated the natural habitat of the various animals. Here we found that those animals which showed a lowering of physiological condition lived rather deep under the surface of the pond, on roots, where there were relatively few bacteria. On the other hand those that did not show this lowering of condition lived near the surface, in the presence of a great amount of decaying vegetable matter, and hence a great number of bacteria.

² "Sensory Epithelium of Pharynx and Ciliated Pits of *Microstoma Caudatum*," *Biol. Bull.*, Vol. XXIII, No. 1, 1912.

From these experiments we conclude that those animals that live in the presence of a great number of bacteria can withstand the action of these bacteria, while those that do not, can not withstand this action, or that the natural habitat of the animal is the real conditioning factor in its reactions.

The Rhythmic Pulsation of the Cloaca of Holothurians: W. J. CROZIER.

The cloacal region of pedate holothurians contains within itself the mechanism of its coordinated pulsation. The isolated cloacal end pulsates rhythmically for many hours after its separation from the rest of the animal, and forms a very simple prepared object with which to investigate phenomena of rhythmic movement. The rate of pulsation of the isolated cloacal extremity of *Stichopus mæbii* was found to have a temperature coefficient of about 2.4; it was capable of long continuance in water practically free from dissolved oxygen. The coordinating mechanism was much more powerfully affected by nicotine and atropine than by cocaine or morphine. The duration of pulsation and of irritability to mechanical stimulation in diluted sea water was proportional to about the square of the concentration. The alkaline chlorides preserved pulsation and irritability in the order:



was a more powerful depressant than isomolecular or (Mg-) isonic MgCl_2 . Each one of the salts of sea water was necessary for the continuance of pulsation; this was notably true of MgSO_4 , which led to normal relaxation after systole. Alteration of the C_H from $\rho_H = 8.0$ (normal) to $\rho_H = 6.0$ was sufficient to produce stoppage of pulsation within 5 minutes. The brownish skin pigment was given out under abnormal ionic or osmotic conditions, and afforded some index of permeability changes.

Ecology

Altitudinal Distribution of Plankton Crustacea in Colorado: G. S. DODDS.

In 284 collections from 124 lakes and ponds, at elevations between 4,100 and 12,188 feet, the author found 50 species of Entomostraca. Other records raise the list to 69 species (Phyllopoda 14, Cladocera 35, Copepoda 20). There are 22 species confined to the mountains, 27 found only in the plains, and 20 range more or less widely through both areas. More definitely, there may be recognized four zones, marked more or less clearly

by physiographic, climatic and faunal characters, as follows: Plains Zone, up to 5,400 feet; Foothill Zone, 5,400 to 8,500 feet; Montane Zone, 8,500 to 11,000 feet; Alpine Zone, above 11,000 feet. In determining distribution of species and boundaries of zones, temperature seems to be the most important factor.

In climate and fauna, these zones have their nearest geographical equivalents as follows: Alpine zone to Labrador, southern Greenland and extreme north of Russia; Montane and Foothill zones to the region north of Lake Superior, Newfoundland, and the main part of Norway and Sweden. The plains zone to the Mississippi valley and the lowlands of Europe, except that the semi-arid climate gives some specialized features.

The Land and Fresh-water Crustacea of Colombia: A. S. PEARSE. (Lantern slides.)

The Vertical Distribution of Some Plankton Protozoa in Wisconsin Lakes: CHANCEY JUDAY.

An Experimental Transmission of Sarcocystis Tenella: JOHN W. SCOTT.

Exceptional Life-histories Among the Unionidæ: ARTHUR D. HOWARD.

Glochidia of a fresh-water mussel (Unionidæ) were found upon the external gills of *Necturus maculosus*. Eighty per cent. of the collections from the Mississippi were infected. By keeping the necturus alive from October to May the larval mussels were carried through the metamorphosis. The species was still unknown, as it did not correspond with any of the collection of glochidia available and which was supposed to be complete for the region. Study of the ranges of all reported forms revealed one rare species, *Hemilastena ambigua* Say, which might be the adult desired. Gravid mussels containing glochidia were found after considerable search late in September and a comparison with the glochidia in question removed all doubt that they were of the same species. The mussel has the unusual habit of living under flat stones of the flag-stone type. As *Necturus* is known to frequently seek such shelter, the manner of infection is explained.

Anodonta imbecillis has been reported by Sterki as normally hermaphroditic and by Howard as non-parasitic. The embryos have been observed within the egg-membrane up to the attainment of the juvenile stage. They were found to escape from the parental marsupium in late spring and their development followed to a growth of shell many times that of the original glochidium. Observations of the degree of development at various

seasons show a lack of agreement with conditions to be seen in most bradytictic or long period breeders. The following counts illustrate this:

Locality	Date	Eggs				Total
		Early Embryo	Late Embryo	Glochidia	Juveniles	
Moline, Ill...	November 7, 1913	7	3	7	5	22
Fairport, Ia..	May 1, 1914	2	1	5	6	14

Glochidia of *Strophitus edentulus* escaping at various times during the spring from the parent mussel were tested for reactions to sodium chloride, the blood of fishes and contact of fins. A closing reaction was seen in each case. This led to an attempt at normal infection with entire success. The juvenile stage was obtained after a parasitic period of 27 days on the black bass. We have failed, after studies covering two years, to observe development without parasitism in this species. It would seem, therefore, that non-parasitic development as reported for this species is exceptional.

The Isolation of the Okefinokee Swamp Islands, a Segregative or Convergent Factor in Species Formation: ALBERT H. WRIGHT.

The Reaction of Herring and Other Salt-water Fishes to Decomposition Products Normal to Sea-water: V. E. SHELFDORF. (With lantern.)

Herring are very sensitive to hydrogen sulfide and carbon dioxide, dying very quickly in small quantities of the former and more quickly than fresh-water species in fatal concentrations of the latter. They turn back upon encountering hydrogen sulfide in sea water and react to hydrogen ions, selecting essential neutrality with a precision showing sensitiveness equal to litmus. When differences in acidity are present they do not react to differences in salinity and density. They react to differences in temperature as small as 0.2° C.

Some Results of the Indiana Lake Survey: WILL SCOTT.

Some Phenomena of Parasitism with Especial Reference to the Unionidæ: ARTHUR D. HOWARD.

The usual type of parasitism among the Unionidæ is little more than commensalism, apparently. The young mussel or glochidium is embedded in the epidermis of the host, where in the process of metamorphosis little besides protection

and transportation are afforded. In addition to this common and intermediate condition we meet with two extremes; on the one hand, a pronounced dependence upon the host in which considerable growth of the parasite takes place as in the Proptera group. On the other, a complete loss of parasitism with independence of a host in which the glochidium remains in the maternal marsupium until the adult form is reached, as in *Anodonta imbecillis*. The existence of these extremes with intermediate gradations presents quite a range of conditions. The observation of loss of parasitism in *Anodonta imbecillis* brought up the question as to how far the normal appearing glochidia had lost the function for which their structure adapted them. Fresh-cut fins with the blood from live fishes were presented. The snapping reaction was obtained. Infection on fishes was tried without success until glochidia from a number of individuals were used. Infection with complete encystment was then secured. They were not carried beyond this stage.

The recognition of restricted parasitism among the Unionidæ has led to the discovery of some interesting ecological relationships, such as *Anodonta pustulosa* to the catfishes, *Quadrula ebenus*, to the herring; *Lampsilis anodontoides* to the grapiques, the Proptera group and the Plagiolas to the sheepshead.

The relationship between *Hemilastena ambigua* and *Necturus* is about the only case of which we have anything like a complete knowledge. The others mentioned are only a few of those known from hundreds of species of mussels the hosts of which are not known.

The elimination by fish of inappropriate mussel parasites is a phenomenon which we have often observed. The process seems to be one of catarrhal shedding of the external epithelial cells of the fish's gills. Such mechanisms of immunity raise the question as to the perhaps more wonderful adaptations seen in the persistence of the parasitic glochidium when it finds the appropriate host species.

Miscellaneous

Problems of Antarctic Bird Life: R. G. MURPHY.
Some Experiments on Protective Coloration: R. G. YOUNG.

The various theories of protective coloration are based on the assumption of the usefulness of such color. This has frequently been questioned, and lacks as yet adequate experimental support. In order to test the usefulness of color in protecting

animals from their enemies, a series of about 140 experiments, covering a period of six years, has been carried out with various species of caged, and in a few cases with wild birds, to which were fed several kinds of small mammals and insects. The latter were placed upon different backgrounds, with some of which they formed strong contrasts, while others they closely resembled. The birds were then allowed to choose between that prey which resembled, and that which contrasted with its background.

The experiments may be divided into two classes—those in which the birds usually approached their prey swiftly from a short distance, and those in which they approached it slowly, and seized it only after careful inspection. In the former class over 90 per cent. of the combinations chosen were contrasting, while in the latter, the contrasting combinations were chosen but little oftener than the non-contrasting ones.

The experiments indicate that the color of a motionless animal has a decided survival value when it is attacked by birds which approach it swiftly from a distance of even a few feet.

Immunity of Fowls to Cysticerci of Certain Cestodes: J. E. ACKERT

Regeneration of Head Parts in Earthworms After Removal of the Anterior Portion of the Digestive Tube: H. R. HUNT. (Introduced by Herbert W. Rand.)

The object of these experiments was to determine whether the brain and commissures could be regenerated and the stomodeum formed in regenerating earthworms in the absence of the anterior end of the digestive tube. The first three anterior segments of the worms were removed and the digestive tube carefully removed from the first five or six segments posterior to the point where the head was cut off. One hundred and seventy-seven individuals of *Eisenia foetida* and thirty-two individuals of *Helodrilus calliginosus* were used. Seventy-eight worms survived. In six specimens head parts regenerated when the anterior end of the digestive tube was three to five segment lengths from the anterior end of the worm. The six worms fall into three classes: in the first class a stomodeum was formed; in the second class a brain fundament and commissures were regenerated; in the third class a brain fundament and commissures regenerated and a stomodeum was formed.

I am indebted to Professor H. W. Rand, of Harvard University, for many helpful suggestions.

An Interesting Snail from Minnesota and a Problem in Geographical Distribution: R. W. H. WOLCOTT.

Exhibits

During the meeting the following exhibits were made in one of the rooms of the Zoological Laboratory of the University of Pennsylvania:

Exhibits and Demonstrations

Franklin D. Barker: The Absence of Male Reproductive Organs in Trematodes.

J. W. Mavor: The Larval and Post-larval Development of the Coral, *Agaricia fragilis*, Dana.

Chester H. Heuser: Drawings and Models of the Stomachs of Embryo Cat, Albino Rat, Pig and Sheep.

E. J. Werber: Demonstrations of Some Sectioned and Unsectioned Material of Monstrous Embryos of *Fundulus*.

Harold S. Colton: Methods Used in Producing Changes Within Pure Lines of the Pond Snail, *Lymnaea*. (Room 104, Zoological Laboratory.)

T. H. Morgan, A. H. Sturtevant, C. B. Bridges and H. Muller: Demonstration of the Four Hereditary Groups and the Four Pairs of Chromosomes of *Drosophila*.

S. O. Mast: Autochromes from Life Showing Adaptation in Color in Flounders.

CASWELL GRAVE,

Secretary-treasurer, American Society
of Zoologists

SOCIETIES AND ACADEMIES

THE AMERICAN MATHEMATICAL SOCIETY

THE one hundred and seventy-fifth regular meeting of the society was held at Columbia University on Saturday, February 27, 1915, with an attendance of 39 members at the two sessions. President E. W. Brown occupied the chair, being relieved by Vice-president Oswald Veblen at the afternoon session. The following persons were elected to membership: Professor J. V. Balch, Bethany College; Professor E. J. Berg, Union College; Mr. Millar Brainard, Chicago, Ill.; Mr. L. C. Cox, Purdue University; Mr. C. H. Forsyth, University of Michigan; Dr. H. C. Gossard, University of Oklahoma; Mr. M. S. Knebelman, Lehigh University; Dr. W. V. Lovitt, Purdue University; Dr. L. C. Mathewson, Dartmouth College; Mr. A. L. Miller, University of Michigan; Dr. Bessie I. Miller, Johns Hopkins University; Mr. I. R. Pounder, University of Toronto; Mr. L. L. Steimley, Indiana University; Mr. Chid-Cheow